



U.S. Department of Energy  
Energy Efficiency and Renewable Energy

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# Wet Gasification of Lignin-Rich Biorefinery Residues

**DOE OBP Thermochemical Platform Review Meeting  
June 7-8, 2005**

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- **OBP Pathways and Milestones**
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- **Plans and Resources for Next Stage**
- **Summary**



# Pathways and Milestones – C-level and Project Milestones

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Ag Residues

Perennial Grasses

Woody Crops

Pulp and Paper

Forest Products

**Validate Gasification Performance**

M 4.11.2

M 5.11.2

M 6.3.3

Project Milestones	Type	Performance Expectations	Due Date
Wet Gasification Task	D	Complete bench-scale testing of catalytic wet gasification with mineral and sulfur removal using lignin-rich biorefinery residues	Sept. 2005



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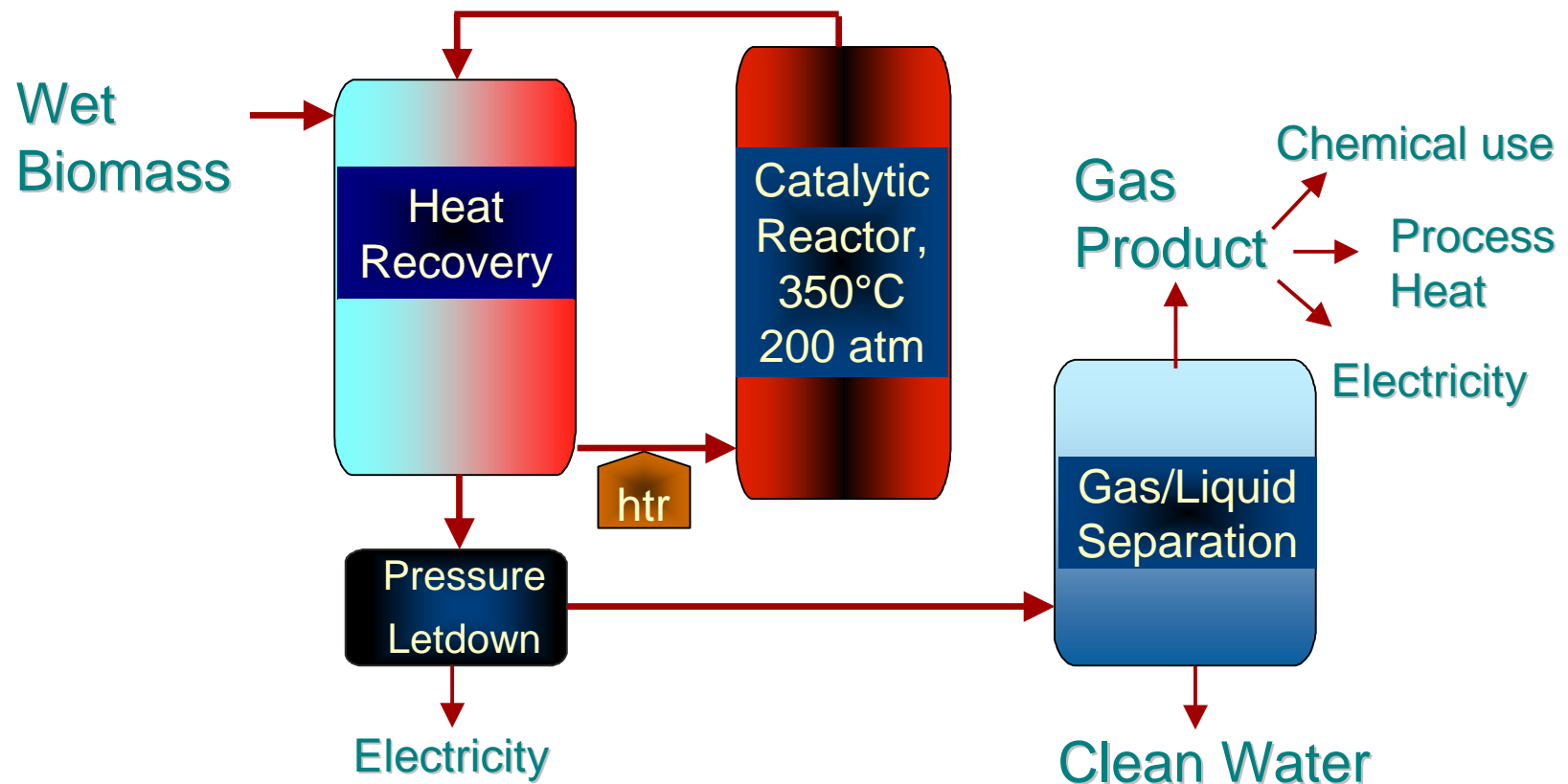
- Refocused Thermochemical Platform work's near-term emphasis on the integrated biorefinery
  - expectation of high-moisture content byproduct streams
  - uncertainty surrounding the costs of drying such materials versus “wet gasification,”
- Wet gasification is the use of high-pressure in gasifying feedstocks in a high-moisture environment.
  - heterogeneous catalyst at low temperature (350°C)
  - medium-Btu gas consisting primarily of CH<sub>4</sub> and CO<sub>2</sub>.
- Process improvements are needed to address the feedstock contaminants and their impacts on the catalyst.

Stage A



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## Catalytic Hydrothermal Gasification in Pressurized Water





# Technical Feasibility and Risks

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- Bench-scale verification of process modifications for sulfur and mineral removal with lignin-rich biorefinery feedstocks
- Extrapolation of technology to different feedstocks, which will require feeding systems as well.



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- **Competitive Advantage**
  - Many of the residues streams from the envisioned biorefineries are wet sludges
  - This project will provide actual verification of the wet gasification technology with feedstocks envisioned in the FY08 Biorefinery solicitation.
- **Competition**
  - Development of more efficient drying systems



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- Bench-scale continuous-flow reactor system at PNNL.
- Existing processing system with modifications.



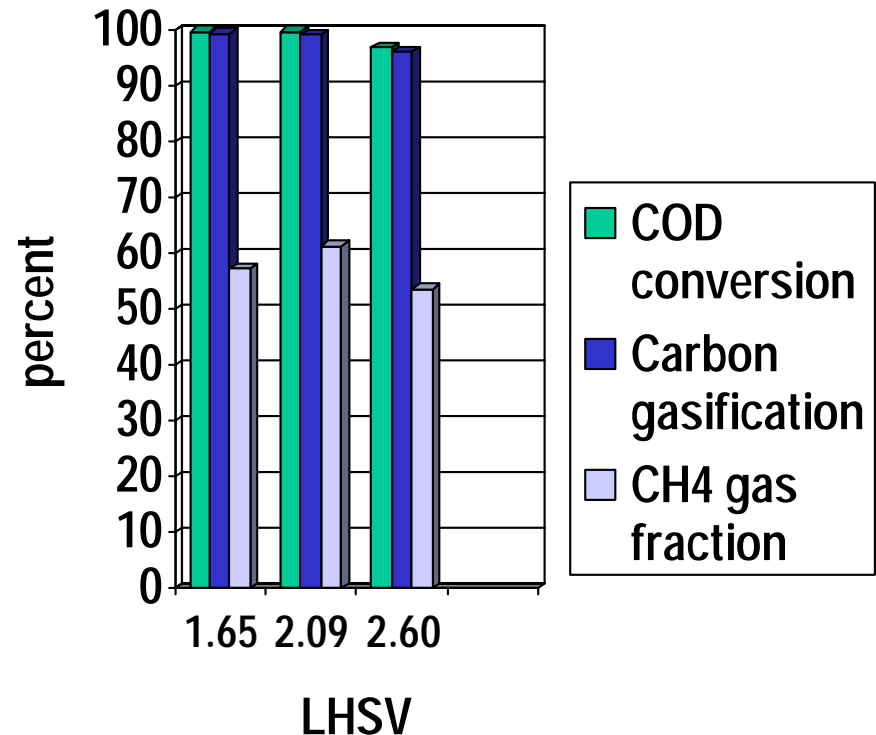




# History and Accomplishments

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- Low-Temperature Catalytic Hydrothermal Gasification capability is well-demonstrated at PNNL
- Application of the technology to wet biomass has shown promise
- Feedstock contaminant degradation of the catalyst is the major technical barrier





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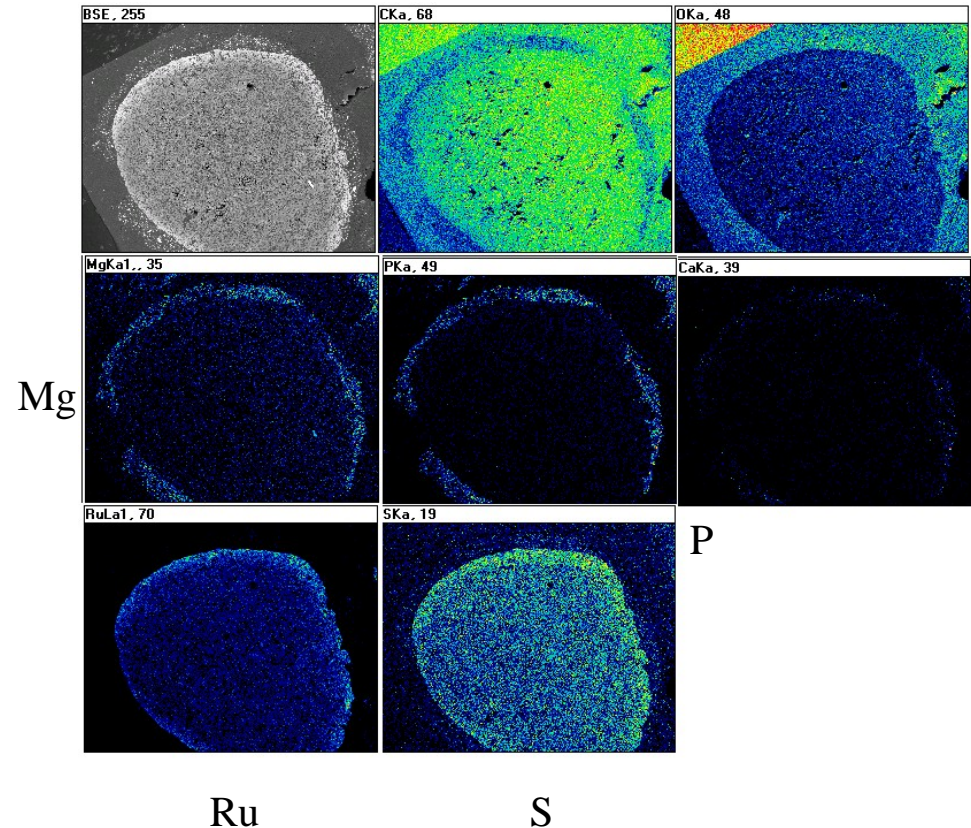
- FY05 project
  - Planned completion
  - Results will be available for integration into biorefineries in FY08 solicitation



# Critical Issues and Show-stoppers

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- Capture of sulfur and minerals
- Catalyst lifetime will be verified for short-term





# Plans and Resources for Next Stage

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- This project is complementary to the Antares-Eastman-Galleon CRADA project.
- Further need of catalyst lifetime studies may be indicated.



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- Short-term project to validate the use of catalytic wet gasification with biorefinery lignin-rich residues in anticipation of FY08 solicitation.